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EDITORIAL NOTES

FUEL TARGET

TO cry over spilt milk is wholly unprofitable, but it remains unfortunate that in the past insufficient weight has been given to the way in which use of the Gas Industry's smokeless fuels, gas and coke, conserves coal. In present circumstances the matter is of two-fold importance in that benzole is needed—and benzole is a product of carbonization—and because of the obvious and the urgent need to economize in coal, and the products derived from it, to the utmost. Striking figures have been given of the amount of coal which could be saved if in the first instance it was treated at a gas-works (we include coke ovens). Our statement that the use of gas and coke for the provision of a heating service makes so large a contribution to fuel conservation that ultimately a great extension of the Gas Industry will be essential is not based on mere partisanship. Under conditions as they are it is needful to exercise the most rigid economy in the use of rubber, of petrol, of coal—and the labour situation, the limited availability of manpower for civilian requirements, is well enough known. The burning of raw coal is wasteful in relation to coal conservation; it is also wasteful in the tyre wastage, the petrol consumed, and the manpower needed to deliver the coal into the consumers' cellars or storage. Use of labour and extraneous raw material in acutely short supply is minimized by the piping of gas to its point of consumption. Rightly, gas and electricity undertakings are doing their utmost in every possible way to lend their support to the fuel economy campaign of the Government, but it is salutary to regard the whole matter of fuel economy in a right perspective. When balance is brought to bear on the problem of bridging the gap between coal production and coal consumption, it is not difficult to see where concentration of saving should be directed.

We return to this subject in the light of an excellent discussion at Gas Industry House last Friday night, when Mr. E. S. Stredwick, of the South Metropolitan Gas Company, gave a Paper to the London Juniors on the Fuel Target. Every economy must be made in the use of gas and electricity. Yet it is well to bear in mind that the amount of coal burned as solid fuel in the home is of the order of 40 million tons a year, that the coal used as gas represents only 6 to 7 million tons, and as electricity about 4 million tons. At the meeting it was emphasized that room warming and water heating account for about three-quarters of the fuel used in the home, and that this is still carried out for the most part by solid fuel. About one-fifth is used in cooking and about one-twentieth in lighting and for miscellaneous purposes. If the gap between production and consumption is to be made good by economy, it is in solid fuel that the really big savings must be made. It is on this that we should concentrate. If every family saved 5 lb. of coal a day during the heating season, it is estimated that the nation would save over 5½ million tons a year. Gas undertakings throughout the country are, as we have said, backing to the utmost the Government fuel economy campaign. The available personnel of gas showrooms are giving advice. They should not confine themselves to gas, but should be able to guide consumers broadly on fuel saving as a whole. Last winter, owing to shortage of coal, some families sat round their gas cookers in order to keep warm. The gas cooker is, of course, a flueless heater. Not the best method of room warming, but in point of fact these people were saving coal.

The Author of the Paper last Friday dealt in detail, and, we think, helpfully, with the fuel target and its implications; the Paper should help all those who have to advise the public on economy, and to give a picture clearly of what is wanted and how best to set about achieving it. Analysis of the proposed rationing scheme as set out in the Government's paper on "Coal" last June shows that the "personal allowance" is sufficient to cover a reasonable amount of cooking and some water heating. The allowance for water heating is austere. It permits of one "small bath" a week; and the Author concludes that hot water service is largely supplied by public baths and solid fuel. An important point is, however, that if cooking and water heating were provided by gas the target "personal allowance"—even this wartime bare-requirement quantity—would represent a considerable increase in our domestic gas sales. There is surely something to think about in this. Before the war, competition for these loads between gas and electricity was so keen that it was becoming more difficult for either to supply the services on an economic basis. Competition does not exist now. Will co-operation continue after the war?

The fuel target is, we think, teaching the public to regard their fuel supplies in better balance. The public is being educated to link up gas consumption and electricity consumption with coal consumption, and to realize that all fuels have their common source in coal—that their gas and electricity bills are not something remote from their coal bills. The path indicated is for the Gas Industry post-war to offer a complete domestic fuel service covering the whole of the ground covered by the fuel target under discussion. In the heating field, the coal fire, irrespective of the work it involves, appeals to the public. Gas-heating appliances will have to embody features which make their attraction to the individual equally strong, and, essentially, the commodity rate for gas must be little if any above solid fuel costs. On this basis only can we hope to supplant the coal fire. Granted this premise, we believe that conversion to gas heating will take place less gradually than many people anticipate.

WHO KILLED COCK-ROBIN?

BEFORE the war, in conversation with several friends—gas engineering friends—who visited the Continent of Europe frequently and more for business than for pleasure, we were told that the Germans were inclined to be boastful of their achievements in the realm of science. Even in gas engineering? we asked; and having heard the affirmative we countered by suggesting that science, and that very minor branch of it, gas making, knows no frontiers, no dividing walls under which men hide for a time waiting till they can "have a pot" with their scientifically constructed pea-shooters against their fellow-men. What brought this to mind is an article by A. K. Bruce which we read in the *Engineer* of Nov. 6. It was about the origin of the internal combustion engine, and had as its premise a remark made by a certain Hugo Güldner in a book of technically high standard (which, unfortunately, we have not read) entitled *Das Entwerfen und Berechnen der Verbrennungskraftmaschinen*—the design and construction of internal combustion engines. In this non-frontier realm of science, Herr Hugo Güldner, acknowledged expert in his particular line of brain-selling, made the statement that "Everything that has served to lay the foundations of the internal combustion engine industry and that has helped to make it vital and important is either the product of German thought or was first made practical on German soil." The Author of the article in the *Engineer*

refused to stand for this; and we ourselves are not exactly enamoured of the idea.

Mr. Bruce pointed to a few home-truths. There was, for example, a "gentleman" of Derby—who, by the way, lived during his inventive period in the parish of Nuneaton—who took out in the year 1791 a patent (British) for a constant pressure combustion turbine. Many believe this to be the first attempt to obtain motive power from the distillation of coal. Then, in 1794, a varnish manufacturer of Surrey, by name of Street, patented an atmospheric gas engine using the "spirits of tar." In 1823, Samuel Brown, of Printing House Square, was active in similar pursuit; so was Brunel in 1825; so was L. W. Wright, of Southwark, in 1833, with his "double-acting gas engine." It was in this year that Otto of the Otto cyle was born. Daimler was born a year later. At the time when Otto had reached the mature age of six and presumably was not averse to Apfelkuchen an ironfounder of breezy Brighton, one William Barnett, had patented quite a serviceable gas engine which was made and sold and proved more successful than many that followed it.

To return to the opening sentence of this note, as far as the Gas Industry goes we think that if needs be we could cock a snook at the Germans if they suggested that it was really the outcome of German thought. Science knows no frontiers and we are ill-practised in snook-cocking, but we think we are right in saying that the first public gas-works to be erected in Germany was in Hanover—and the works were erected by a firm of English engineers. Prior to this, Paris had had gas-works, and Paris followed London. Germany, it may be mentioned, did not in her town gas achievements outstrip Baltimore in U.S.A.

And how does Germany stand as a pioneer in another branch of carbonizing—the coke oven? In 1735 Darby, an English "gentleman," was using coke very successfully at Coalbrookdale in Shropshire. In 1750 its use in England became extended. Perhaps it was thought of reward that made John Beal emigrate to America to sell coke. Anyway, in 1813 there was an advertisement in the *Pittsburg Mercury* to the effect that this gentleman possessed a knowledge of converting "stone coal into coak." We believe that in 1766, at Sulzbach, there was a coke retort installation; but it was crude and proved of little practical value. In France, Knab had a workable process in 1856; and Carvés (France) and Simon (England) made valuable improvements on the Knab oven, and these came to fruit in between the years 1862 and 1873. Germany was also "mopping up" at the time, and in 1881 Hüssner got into his stride on previous thought, and so did Otto, who was helped no end by Hoffman. We think, however, that Coppée, of Belgium, whose oven was introduced on the Continent prior to 1861, and was introduced in England in 1873 and 1874, had—as far as original thought goes—a great deal to do with the development of both the Otto-Hoffman and the Simon-Carvés systems. Of course, we are going back a long way. If we delve further into history, no doubt the Germans would say that the coke oven is obviously of German origin, for did not Julius, Duke of Brunswick, recommend carbonization as long ago as 1584? Our answer is simple. In 1589, Procter, Paterson, and Dudley were hard at the same game and were less theoretical than Julius. Five years later? Think of the time taken for communicating thought in the sixteenth century.

And do the Germans claim first place in the coal tar industry? Henry Haskins, surely an Englishman, was granted in 1746 a British patent for a "new method of extracting a spirit of oil out of tar, and by the same process to produce the finest of pitch." We will jump a year or two and come to Mr. Mackintosh, who was supplied with spirits from coal tar by Dr. Longstaffe and Dr. Dalston, who were responsible for the first coal tar distillery, which they erected, near Leith, in 1822. Ammonia is derived from coal. Who discovered ammonia? Hippocrates (fifth century before Christ), Dioscorides in *Materia Medica* (50 B.C.), or the Dynasty which ruled in Egypt in A.D. 400, and found it profitable to distil ammonia from camel's dung? An Arabian polyphister by name of Al-Garitz wrote a certain amount about ammonia in 869. Whose were the first factories set up for the production of sal-ammoniac? We think the names were Dovin and Hutton and that their factory was in Edinburgh. In any case, the "discovery" of ammonia was made by Priestley (non-Nazi) in 1774.

Science knows no frontiers. Boasting, even on the Nazi system, will achieve no scientific victory—least of all in the sphere of imaginative thought.

Standardization of C.A.B. Test

A useful Paper has been given to the Institute of Fuel by D. H. Bangham and G. C. Phillpotts, of the British Coal Utilization Research Association, on the standardization of the critical air blast test. The test was devised by Blayden, Noble, and Riley primarily in order to assess the suitability of cokes in the domestic grate, and it has been fully described in the "JOURNAL." It has the merit that it is carried out with the fuel actively burning, the aim being to find, by trial and error, the minimum air supply which will maintain combustion for 20 minutes in a bed of sized fuel which has been ignited under standard conditions. The ability of the bed to resuscitate with increased blast rate is the criterion of maintenance of combustion. Another merit of the test is that the use of a furnace of accurately controlled temperature is rendered unnecessary. It has been shown that the performance of a fuel in small high-velocity producers such as are used for road transport depends more on its combustibility than on its ability to reduce carbon dioxide. The volatiles, which help flexibility of the fuel, also assist the fuel to remain alight under the conditions of the C.A.B. test. For these reasons the C.A.B. test was adopted as the basis for assessing "reactivity" in the provisional specification (1940) for transport producer gas fuels drawn up by the Joint Committee of the Coal and Carbonization Industries. The work of standardizing the test prior to its adoption as a B.S.I. standard of reactivity was undertaken by the B.C.U.R.A. in collaboration with the Fuel Research Station, the Gas Light and Coke Company, I.C.I. (Alkali), Ltd., the Midland & Northern Coke Research Committees, Powell Duffryn Associated Collieries, Ltd., and the Swansea Technical Institute. The Authors of the Paper in question explain that discrepancies between the C.A.B. values recorded in different laboratories for samples of identical fuels have been traced, first, to variations in the method adopted in packing the fuel bed (a loose even packing should be aimed at; and the bed should be smoothed, not pressed, with the former in levelling the surface); secondly, to variations in the energy output of the heater if this is below 160 watts (a heater of 180 watts is recommended); thirdly, the restriction of the air-flow at the exit from the fuel bed in apparatus of the original Riley design. It is recommended that this effect should be eliminated either by using a straight-sided tube with unrestricted outflow through the perforations of the bed support, or by the use of a very deep fuel bed. Certain factors have been found to influence the ignition time, but to have only an insignificant effect on the C.A.B. These are variations in heater output if the latter exceeds 160 watts, the distance from heater coils to the fuel bed surface, and starting with a cold apparatus. A British Standard Specification based on these conclusions has been drafted and will shortly be issued by the B.S.I.

Gas Supply Limitations in America

An Order issued by the U.S.A. War Production Board restricts delivery of manufactured gas to new industrial and domestic consumers. It is designed to cope with gas shortage expected this winter. No gas may be supplied to a non-domestic consumer for the operation of any gas-fired equipment which was not in use prior to last September unless the capacity of the new equipment is less than 150 cu.ft. per hour, or it replaces existing equipment of the same or greater capacity, or there is a special W.P.B. grant. Again, as from last September, no gas may be supplied for space heating in home, office, or factory unless the equipment was installed previously, or replaces equipment of the same or greater capacity. In addition to restrictions on new deliveries, the Order requires gas undertakings to operate their systems in such a way as to obtain maximum output of gas in any area in which a gas shortage exists or is threatened. Each undertaking must investigate the availability of gas production facilities owned or operated by a non-utility producer in the area and arrange for the use of such facilities when needed. The Order lays down the sequence which a gas undertaking must follow in curtailing customer's supplies in the event of shortage. Regarding heating equipment, a further Order permits the sale of any equipment needed to convert oil and gas burners to coal, and the sale of any equipment specifically designed for barbers' shops or "beauty shops" (W.P.B. Limitation Order L. 79).

Another War Story Needed?

Doubtless many of our readers will have enjoyed and profited by the Ministry of Information's latest shillingsworth—the official story of British Transport, 1939–42. It is a remarkable story of remarkable achievement in a period bringing unprecedented difficulty, entirely new problems, but also, fortunately, flexibility in working and a measure of fortitude of which we can all feel very proud. *Transport Goes to War* has 80 pages of reading-matter and photographs, and it tells the inner story of the railways, the buses, the ports, and the waterways in the blackout and in the blitz. It is altogether inspiring. An impressive story, too, could—and we suggest should—be told of the vicissitudes of the public utility undertakings during this period of weird conditions; of how extraordinary situations were faced, always with the public's welfare as primary concern; of the way in which thousands of workers in the Gas Industry and the other utilities dealt with their tasks. It would, we think, constitute a record of absorbing interest and value.

Professional Scientists and the Nation

The Institutes of Chemistry and Physics, in association with representatives of other professional scientists, have set up a Joint Council of Professional Scientists under the Chairmanship of Sir Robert Pickard to "voice the collective opinion of qualified scientists on matters of public interest, and to provide a liaison between professional organizations of scientists for co-ordinated action in matters of public interest." We learn that the Council intends to concern itself in particular with the use of scientists to the best advantage in the service of the community, their education, training, supply, and employment, the maintenance of adequate qualifications, and the supply of information and advice to public and other bodies. The Council has been established for the period of the war, but it may form the nucleus of some more permanent organization. The Hon. Secretary is Dr. H. R. Lang, and the Council's temporary address is The University, Reading.

How Many Matildas?

For more than 80 years the inhabitants of a village in Northumberland were served day and night by gas on tap produced locally. True, the output of the works was not spectacular, but it grew steadily till it tipped the scales at 2 million cu.ft. per annum. A week or two ago a lady scrap metal locator empowered by the Ministry of Supply was taking the air in the neighbourhood when her eye-location system found its ray pierced by the gas-works. The village constable happened to be beating time at the time. "What is that I see?" asked the lady locator. "Them's the gas-works," was the reply. Fired by visions of Churchills and General Grants, the locator quickly located the owner of the works, transacted a spot-cash sale, and within a few minutes ten men were at work with demolishing tools. Amid the din of hammering, the Parish Council handed to the locator 22 gas lamp standards which had shone for so many years and so steadfastly on the goings and comings of the dwellers in the village. Alnmouth Gas-Works is no more, but its end was not inglorious.

Personal

As from Dec. 1 Mr. G. E. H. KEILLOR takes over the position of Manager to the Marple Gas Department. Trained at the Greenock Gas-Works, Mr. Keillor held appointments at Blackburn, Dunfermline, Colombo, Cambridge, and Worcester.

* * *

The death of Alderman J. H. Brogdon, J.P., of Hexham, has created a vacancy on the Board of Directors of the Hexham Gas Company, of which he was the Chairman. Mr. Geoffrey Nicholson has been appointed Chairman, and the vacancy on the Board has been filled by the election of Mr. H. DOUGLAS LEES, M.C., who has held the position of Engineer to the Company since 1926.

We are Advised by Simon-Carves, Ltd., Cheadle Heath, Stockport, that owing to the paper restrictions they are unable to send out this year their usual Calendar. Inaugurated by the late Mr. Henry Simon more than 50 years ago, this day-by-day calendar, with a quotation for each day, achieved considerable fame at home and abroad. Those who have been recipients in the past will miss during 1943 the familiar yellow and brown of the Simon-Carves' Calendar.

Wartime Damp-Proof Courses

The British Standards Institution has recently issued a new Standard entitled "War Emergency British Standard for Coal Tar Pitch Felt Damp-proof Courses for Temporary Wartime Building," B.S. 1067, which has been prepared at the request of the Ministry of Works and Planning and is issued under their authority, having been approved by the Standardization Committee of the Ministry. Any revision of this Standard will be undertaken only on the instructions of the Minister.

The Specification has been prepared as coal tar pitch is likely to be the only material suitable as an alternative during the war for bitumen felt damp-proof courses referred to in B.S. 743. It is intended to be used for temporary wartime buildings only and is not at present suitable for permanent construction.

The Specification is issued for the use of all technical officers of Government Departments and their agencies, local authorities, and independent architects and engineers advising Government Departments, as well as building contractors. The Specification is accepted and will be followed by all Departments concerned unless there is sufficient reason to justify a departure being authorized.

Copies of the Specification may be obtained from the British Standards Institution, 28, Victoria Street, S.W. 1, price 1s. net (post free, 1s. 3d.).

Non-Ferrous Metals Control—Lead Pipe

Owing to the increasing demand for lead for the war effort, the utmost economy must be attained in the use of lead pipe in the Gas Industry.

An arrangement has therefore been made with the Non-Ferrous Metals Control that in order to regulate supply of lead pipe required by the Gas Industry, allocation of supplies to particular gas undertakings shall be based on a sliding scale, provided the material is used only for meter connexions and essential repairs.

A letter concerning this arrangement has been sent to all gas undertakings, and further particulars can be obtained from the Secretary of The Institution of Gas Engineers.

Fuel Testing*

The first edition of *Fuel Testing*, by G. W. Himus, was reviewed at some length in the "JOURNAL" of April 6, 1932. The second edition has now been published, its contents being nearly 50% more than that of the first edition. The same general plan as adopted in the original edition has been followed, but there have been certain modifications, the most important of which are the omission of the introduction and the chapter on the classification of coal, and the addition of a chapter on combustion calculations—the latter being a welcome widening of the scope of a work which has obvious significance and usefulness at the present time. Descriptions of analytical methods have been brought up to date, and are consistent with those recommended by the British Standards Institution, the Fuel Research Board, and the Institute of Petroleum. As mentioned, these additions have necessitated an increase in the size of the book. The text is illustrated by 59 diagrams, and the book is produced in conformity with the authorized war economy standards.

* *Fuel Testing*, by G. W. Himus; published by Leonard Hill, Ltd., price 21s. net.

The Gas Supply Co., Ltd., of Melbourne, have declared a dividend at the rate of 3% for the half-year ended June 30, 1942, making a total for the year of 3½% actual. Profits for the period were £11,947, compared with £18,099, the reduction being due to various war causes, including a considerable decrease in gas consumption in the two areas of North Queensland served by the Company.

Meetings of the London and Counties Coke Association will be held on Dec. 21 at Gas Industry House as follows: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 2 p.m.

A Meeting of the General Committee of the National Federation of Gas Coke Associations will be held on Dec. 8 at Gas Industry House at 10 a.m.

The Burgh of Airdrie have agreed to reduce the price of gas by 6d. per 1,000 cu.ft. as from the November survey to all consumers, except in the case of special industrialists, where a reduction of 17½% is agreed to.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

BENZOLE RECOVERY BY GAS OIL*

By B. RICHARDSON, Newcastle and Gateshead Gas Company

IN all probability those of you who are employing gas oil in your benzole washers will have noticed a tendency for this oil to form emulsions with water and thereby cause trouble both at the scrubbers and also at the debenzolizing plant. There has been considerable controversy as to how such emulsions arise. I have examined several samples at various times during the past eight years, and in every case have found the emulsions to consist of a brown resinous substance, insoluble or almost insoluble in the gas oil, and closely associated with water and solid particles. On drying, the resinic body resembles snuff and evolves about 40% by weight of volatile matter when heated in a crucible out of contact with air, and the residue is a coherent coke containing some 3% of a pale yellowish mineral ash.

To my mind there is little doubt that the presence of resinic bodies in gas oil is essential to the production of emulsions with water. Several causes operating together or separately have been suggested to explain the formation of such bodies, as for example oxidation of the oil, by oxygen in the gas, the action of sulphuretted hydrogen when crude coal gas is washed, and the presence of tar fog or ammonia. I think, however, that while all these factors may severally have contributed some small share towards causing the trouble, the real reason is to be found in the successive heatings and coolings which the oil receives during its passage around the benzole plant circuit. This causes polymerization of certain classes of unsaturated hydrocarbons present, either in the oil itself or washed out of the gas, and resins, insoluble or only partly soluble in the oil, result. These bodies are frequently precipitated as sludges or slimes upon the interior surfaces of preheater and cooler tubes.

Some time ago I examined a number of samples representing gas oils that had been in circulation for considerable periods, and in almost every instance obtained substantial amounts of resin-like matter when the redistilled oils were treated with 80% sulphuric acid.

To avoid emulsions it is necessary, therefore, first to change completely or partially replace the stock of wash oil in circulation at fairly regular intervals. Secondly, I would advise you periodically to run off any water or sludge that may accumulate in the compartments of the rotary washer or scrubber. And lastly, it is good practice to maintain the temperature of the oil entering the washer at a degree or two higher than that of the incoming gas, for by this means condensation of water vapour from the latter is prevented.

Apart from giving rise to operational difficulties, the accumulations of water and sludges in the oil-flow system of a benzole plant are detrimental on account of their slightly acidic nature. For this reason they have a tendency to corrode the tubes of the oil-to-oil preheaters, and thereby cause leakage of benzolized oil to take place into the debenzolized oil with consequent loss of recovery efficiency.

It is well known that when petroleum oils are used in the presence of hydrogen sulphide they are much more liable to give rise to corrosion troubles than coal tar distillates, and I have invariably found that when fresh gas oil is distilled evolution of hydrogen sulphide takes place steadily, especially during the earlier stages. The sulphur content of sludge, taken as a whole, is often as high as 1.35% by weight.

Steel tubes in benzole plant preheaters are particularly liable to corrosion, and I would strongly recommend the use of wrought iron tubes in such vessels.

Steam Consumption

I have arrived at the conclusion that if the benzolized oil has been preheated to a temperature of not less than 130° C. it is possible thoroughly to debenzolize it by using a quantity of live steam equivalent to 0.52 lb. per gallon, the oil leaving the still yielding little or no distillate boiling below 160°C.

I include the figures representing the total steam consumption, taken over a period of 24 hours, of a benzole plant producing some 500 gallons of spirit per day, the latter having a retort test of 70% at 120°C. and giving 86% distilling at 160°C. by the new evaluation test:

	lb.	%
Steam used on oil pumps and preliminary heater	7,680	14·9
" " oil preheater (indirect steam)	12,810	25·0
" " still (live steam)	6,240	12·2
" condensed at traps on steam range	1,248	2·4
" used on water circulating pumps and lost at blows	23,932	45·5

The steam consumption for debenzolizing purposes only thus works out at 5.1 lb. per lb. of benzole recovered. I may add that a steam meter used in conjunction with a benzole plant is a valuable asset, and can be made instrumental in bringing about considerable economy in the recovery process if its warnings are heeded in an intelligent manner.

The majority of benzole plants are provided with a dephlegmator or "analyzer" situated at the summit of the still fractionating column. If the water supply to the dephlegmator contains several degrees of temporary hardness, trouble is likely to be experienced owing to the tubes with which the water comes into contact becoming coated by a thin scale of calcium carbonate. This detracts from the efficiency of the apparatus and it will be necessary periodically to clean the tubes. If you are compelled to use a hard or muddy water for cooling purposes, see that the dephlegmator has suitable hand-holes provided so that access to the tubes can be obtained.

A note on thermostatic control for benzole plants. It must not be thought that an installation of thermostats will necessarily reduce labour charges; what is effected is the production of a crude spirit more or less constant in quality, irrespective of fluctuations in the steam and oil supply to the plant. Such control will not, in my opinion, obviate those irregularities in working which render a certain amount of supervision necessary even in plants of the most modern type. Moreover, it must not be overlooked that the first cost of a so-called automatic control may be equivalent to several years' labour charges on a hand-operated plant.

Excessive labour charges attendant upon old-fashioned plants such as were erected during the last War appear to have been due not so much to the lack of control facilities, but to faulty lay-out and design necessitating a multiplicity of pumps (oil and water), a complicated system of oil storage tanks of large dimensions, and a large volume of wash oil in circulation, necessitating frequent pumping and changing of valves.

In a modern thermostatically controlled benzole plant simplicity is the keynote. Oil stocks and oil-to-oil heat exchangers are kept at the minimum, with the result that while little supervision may be required, steam consumption is fairly heavy, more cooling water is needed, and the debenzolized oil and make-up losses will increase. Further, an "automatic" plant may develop a fault and run unattended for some considerable time if not periodically visited and inspected.

Therefore, to my mind, it is not possible to provide an entirely "labourless" benzole plant. Those who fall for the "bait" of an automatic installation run without labour may, indeed, be led into paying in increased steam and water charges more than they "save" in labour owing to the charges under these heads being hidden in the works total for steam and water.

Sulphur Recovery

I feel you would like to have a few figures relating to sulphur recovery on an active-carbon process plant, figures I obtained during a recent investigation. This particular type of plant was reported to reduce the sulphur in the gas to from 8 to 10 grains per 100 cu.ft. The average figure obtained over a period of one week was as follows:

Sulphur in gas, Inlet adsorbers—20.88 grains per 100 cu.ft.
" " Outlet " 9.20 " "
Sulphur recovered=11.68 grains or 55.7% of total."

Further investigation showed that the carbon disulphide in the gas at the inlet to the plant was 11.7 grains per 100 cu.ft. and 4.9 grains at the outlet, a reduction of 6.8 grains having taken place, or 58% of the total.

The removal of sulphur from the gas is more complete than is the case with all the oil-washing plants I have examined, though it is not as good as I had expected it would be in view of previously published figures. It is, however, possible that with further experience, and by modifying the cycle period to suit the condition of the charcoal in the adsorbers, these figures will be improved upon.

The average steam consumption on the plant, excluding steam for driving small engine for air compressing and gas boosting, is 4.51 lb. per lb. of benzole, or 40 lb. per gallon.

Discussion

The Chairman (Mr. **F. Nicholls**) remarked that it was a wise precaution to run off the water regularly from the plant. He thought the figures of steam consumption given by Mr. Richardson were moderate. Most of them, he considered, would be getting rather higher averages, especially with modern plant.

Mr. **W. O. Kirkwood** (Sunderland) agreed with the Author's advocacy of wrought-iron tubes for benzole plant preheaters. He was interested to know what uses were made of live steam still available from the plant.

Mr. **U. A. Briggs** (Newcastle) said figures for the older type of plant varied from 80 to 85% valuation at 160° compared with 90 to 97% in modern plant.

In his experience of benzole extraction the plant ran for a time without any trouble from emulsion, and then suddenly trouble developed. It seemed that this occurred when the oil in the washing plant was getting old.

Mr. **Richardson,** briefly replying to the discussion, said that as to steam disposal, surplus steam was used for preheating purposes, while hot water was cooled and used again. He added that they did not carry out full steam recovery, though the subject might merit greater attention on benzole plant. Where creosote oil was introduced into a plant, he advocated that the whole plant be thoroughly cleaned out and no trace of gas oil left. Care should be observed that naphthalene did not form. If naphthalene was present and creosote oil was introduced then trouble was being sought.

Mr. **G. E. Anderson** (Gateshead) proposed and Mr. **W. O. Kirkwood** seconded a vote of thanks to the Author.

* From a Paper to the North of England Gas Managers' Association (Auxiliary Section), Nov. 6.

SMOKELESS FUEL AND POST-WAR RECONSTRUCTION*

By G. E. FOXWELL, D.Sc.

THIS discussion will be based on the replacement of raw bituminous coal for domestic purposes by other fuels, but bearing in mind the possibility that appliances will be available for heating large buildings by coal smokelessly.

If there is likely to be any shortage of smokeless fuels, it should be possible to heat large buildings, whether commercial or flats, by bituminous coal. A certain proportion of large buildings is already equipped for being heated by coke and, no doubt, in the normal course of commercial competition coal and coke will continue to share this market. The essential problem, therefore, is that of providing the necessary heat for replacing raw coal for domestic purposes.

Electricity for heating purposes would be ruled out as a general solution of the problem on the fuel conservation count. Figures given by E. V. Evans† indicate that when the practical efficiency of use comprising cooking, hot water, and heating of rooms is taken into account, carbonization conserves coal, whereas the use of electricity for heating purposes is wasteful of coal.

Carbonization cannot be justified unless the gas and the coke are both satisfactorily utilized. Pit-head carbonization, therefore, involves the use of a gas grid or some other means of proper gas utilization if carbonization is to be justifiable for the production of domestic fuel.

Of the total of 3,230 million useful therms required for complete elimination of bituminous coal from the domestic sphere, 1,880 million therms are already available. The problem is, therefore, to find some 1,350 million useful therms from smokeless fuel per annum.

Carbonization readily fulfils the requirements of producing smokeless fuels that can perform the necessary domestic services at a reasonable price and with the minimum of work to the consumer. If it is to fulfil the further criterion of conserving coal, both the coke and the gas must be utilized. This is also necessary if carbonizing plants are to be financially profitable.

This conclusion should be read in conjunction with a Paper contributed by the present Author to The Institution of Gas Engineers in 1941 on "The Co-ordination of the Carbonizing Industries." It is not intended to repeat what was there said, but it will be sufficient to state the conclusion that full utilization of the products of carbonization cannot be secured unless and until the carbonizing industries are co-ordinated internally and as among themselves.

It was there visualized that this co-ordination might be effected on a regional basis, and that that basis would lead to regional gas grids collecting gas from colliery-owned plants and from gas undertakings alike and supplying it through the gas undertakings acting as salesmen, distribution engineers, and fuel utilization engineers both for gas and coke (excluding metallurgical coke).

Much could be done if both industries were placed under the Gas Administration Department of the Ministry of Fuel and Power and subsequently reorganized into (*a*) gas production, and (*b*) gas distribution and sales. The collieries and larger gas undertakings would function under the gas production section, and the gas undertakings generally would be responsible for distribution sales and utilization. Coke would best be dealt with by the coke associations already in being but in closer alignment than now. Coke associations outside the London and Counties Coke Association and the Coke Producers' Federation have a lot of leeway to make up.

It is within the bounds of possibility that the colliery industry will be reorganized after the war on the lines of a public utility such as the gas and electrical and water industries. In these circumstances the rational utilization of fuel would become much easier. There does not, unfortunately, seem much chance of the gas and colliery interests joining forces at the moment; but if both were controlled by the same Ministry under a considered policy of development, the suggestion might be viewed with less alarm.

With proper organization the bulk of the gas required by the Gas Industry, except in districts so remote from the coalfields that gas transmission would become impossibly expensive, could be secured from coke oven gas. Everything depends on planning the technical development of the coke oven industry after the war in such a way that it is equipped to supply this gas.

Clean coal could be produced for coke manufacture, and the higher ash intermediate product of the washeries could be carbonized in special ovens to provide coke for the producers. In this way, from 20 million tons of coal some 1,400 million therms of gas could be liberated for external use. Allowing 600 million therms for use in the steel works, at least 800 million therms gross, providing 400 million therms of useful heat, could be obtained annually.

Coke ovens can carbonize at maximum practicable capacity some 20 million tons of coal a year, producing about 13 million tons of saleable coke. Between 5 and 9 million tons of coke is required by the iron and steel industry, according to the state of trade. Part of the remaining oven coke is exported (say 1.5 million tons) and part goes for other industrial uses. Some 2 million tons probably reaches the domestic grate. If the market were available and in a normal state of trade, the coke ovens could supply as an estimated figure another 1 million tons of coke a year, or, say, 100 million useful therms.

Wartime experience has shown that the Gas Industry has more surplus capacity than was believed possible. Considerable increases in gas and coke output have been obtained from works without additional plant. Putting this at its lowest, the Gas Industry could readily be expected to obtain an all-round additional output of 10% on existing plant. On 1938 output this would account for 160 million therms of gas, and 280 million therms of coke; on the preceding efficiency basis this would yield (80+100=) 180 million useful therms.

Totals.—From the figures given it may be estimated that much of the 1,350 therms required could be made available without adding to existing plant, by taking advantage of known technique when reconstructing existing plants.

It is estimated that we have from the virtually existing carbonizing capacity:

	Useful therms. (millions.)		(millions.)
Useful therms required	—	.	1,350
Additional coke from ovens ...	100	.	—
Additional gas from ovens ...	400	.	—
Additional gas from gas-works ...	80	.	—
Additional coke from gas-works ...	100	.	—
Useful therms produced ...			680
Additional carbonizing capacity required			670

From the carbonization of 1 ton of coal, some 90 useful therms of coke and gas are available for sale. During the immediate pre-war period coke oven constructional firms were building at the rate of 2 million tons of carbonizing capacity per year, or, say, 200 million useful therms of gas and coke per year. If gas-works contractors were added to this—and bearing in mind that some coke oven builders have gone out of business in recent years—it would appear that there would be no difficulty in making up the additional 670 million useful therms required in three years.

The proper utilization of available sources of gas would suggest standardization of calorific value and other characteristics of gas over each major industrial area of the country. Industry will require greater quantities of gas than before the war, and gas grids will have the advantage (like the electrical grid) of preventing great concentrations of industry and population in small areas.

The principle underlying the co-ordination of gas supplies must be to make use of as much as possible of the surplus gas that exists in the country, from whatever source it may be derived, and to bring gas into the service of industry as widely as possible. The war has shown that concentrations of population are not necessarily advantageous. If we are to remove slums permanently there should be a development of garden cities, and this must involve spreading industry over a greater area.

It seems desirable that the gas and coke oven industries together should set up a number of regional gas grids covering industrial areas. The purely residential and agricultural districts too far removed from a grid would be left to receive their supply from local works as at present.

It is usually possible to prove on paper that the establishment of a gas grid is uneconomic when based upon existing demands for gas. When, however, the gas is available, the demand grows and a sufficient supply can be sold to make the scheme profitable. The provision of gas grids should not be regarded in a narrow spirit of immediate economics. The coke oven industry for its part could assist in the development of these gas grids by centralizing production in very large units situated at a convenient point for the distribution of gas and coke.

If financial difficulties prevent the carbonizing industries from carrying out this scheme it might be sponsored by the Government.

The grid system here visualized would obviate much of the difficulty and the expense now connected with the problem of ensuring continuity of supply.

Conclusions

The conclusions reached are as follows:

1. Improved architectural housing design is essential if fuel is to be used efficiently.
2. Abolition of smoke and reduction of labour in the house must be prime considerations of post-war house planning and of post-war fuel policy.
3. Coal conservation must be the foundation of post-war fuel policy.

* From a Paper to the Institute of Fuel, Nov. 12.
† *J. Royal Soc. Arts*, **86**, 530.

4. The carbonizing industries are best suited to supply the bulk of the smokeless fuel required after the war to carry out this programme.

5. Adequate quantities of smokeless fuels can be made available by carbonization for a post-war fuel policy based on smoke abolition if the carbonizing industries comprising the Gas Industry and colliery-owned plants collaborate fully through regional gas grids.

6. One authority divided into regional boards should control the production and distribution of smokeless fuel based on—

(*a*) A production section.
(*b*) A gas distribution and utilization section.
(*c*) A coke distribution and utilization section.

7. An extension of this scheme would be:

(*a*) Unified research co-ordinated by a central organization for the whole industry based on production, gas utilization, and coke utilization.

(*b*) An extension jointly by the collieries and the Gas Industry of the chemical processing of coal (*e.g.*, the Fischer-Tropsch process) and of the by-products of carbonization, together with an extension of the chemical manufacturing side of the industries. The new organization would thus become a Coal Processing Industry in a very real sense.

Discussion

Mr. **L. N. Horne** said that the Author seemed to overlook the problem of coping with peak fuel loads. A coke-cum-gas heating system could not deal with the winter peak demands, and they could not and should not ignore the buffering effect of having at disposal a variety of fuels. It was the storage of coal for the winter months which made it possible to carry the winter load. Electricity, gas, or smokeless fuel could not cope with it. They must have coal. And there was, he thought, too much talk of unified control. Smokeless fuels varied according to the types of coal from which they were made—and there were many types of coal. The public liked consistency of supply, and it was reasonable to suppose that certain districts would be best suited by certain types of smokeless fuel. Distribution of the various fuels would settle itself in relation to demand. And speaking about distribution of solid fuel—coal—this was achieving a standard pre-war of which they might be proud. He would hesitate to think what would happen if they dispensed with individual control and individual initiative. Public control was not a remedy; private enterprise should continue and be encouraged.

Mr. **A. Marsh** (National Smoke Abatement Society) remarked that a major problem was this: Was new building to be equipped for the best amenities and for good healthy conditions, or was new building to be allowed to perpetuate smoky methods of heating? To his mind town planning could never achieve a full measure of success unless it was accompanied by smokeless methods of heating, unless there was smokeless air. Could not a plan be evolved for the gradual abolition of smoke from the buildings which would exist after the war? Availability of smokeless fuels was, of course, a *sine qua non*, but the needed availability might be achieved in, say, ten years. And he suggested that it was not enough for the Institute of Fuel to receive and comment upon a Paper of the nature under discussion. The Institute should use its influence to bring into practical effect the proposals which the Paper advanced.

Mr. **F. P. D. Scott** spoke of the use of underfeed stokers for burning coal—bituminous coal—smokelessly for central heating of private houses. There were thousands, he said, in Great Britain; they had a high efficiency; they needed less labour than did hand-fired coke installations. His ideal of domestic heating was central heating throughout the house, together with the open fireplace. He had no liking for a so-called ideal house which was a stepdaughter of a second-class provincial hotel complete with gas fires. St. Louis had been mentioned by the Author, and perhaps he was misinformed as to what was taking place there. Enactments there were that the public should use either smokeless fuel or stoker equipment consuming coal smokelessly. Comparative figures for equipment of St. Louis were 36,000 stokers using bituminous coal smokelessly; 18,000 oil-burning equipment; 10,000 gas-burning equipment. The Gas Industry, he thought, thoroughly well represented on many post-war committees, looked forward to a post-war paradise. In which regard he would say that the British public would decide the issue, and this irrespective of the views of expert committees.

Mr. **W. L. Boon** (London and Counties Coke Association) emphasized that fuel conservation was a matter of primary policy in relation to the country's welfare. There was, too, the question of convenience, and the housewife demanded convenience. Development of solid fuel-burning appliances should be towards greater convenience. Regarding heating generally, insulation of buildings was obviously of great importance. With insulation, fuel consumption to maintain present standards of heating could be reduced by 50%; alternatively with the same fuel consumption they could enjoy a 50% better heating standard. He considered that the era of cheap coal was past, that post-war there could not be an immediate, but there would be a gradual, change towards smokelessness, that new building construction ought to have a more positive policy regarding smokelessness. With regard to winter demand, it was a fact that with solid fuel householders could stock heavily to cope with their peak demands.

Mr. **Drummond** remarked that if the domestic coal market passed from the coal industry it was inevitable that the prices of coal for other purposes, for industrial use and for carbonization and electricity generation, would advance.

Mr. **R. J. Restall** (Stalybridge) urged that the fuel industries should have a more closely defined objective, and that the carbonizing industries should abandon the practice of quenching coke with water.

Mr. **G. R. Jackson** said that the opinion so often expressed that the heat passed to a flue by a solid fuel fire was wasted was untrue, or at any rate, if the flue was internally positioned, was untrue. If the flue was inside the building, practically no heat was wasted. And in his view the average Briton had no pleasure in sitting by a gas fire. He preferred an open fire burning coal, or coke, or wood. Essentially, however, more central heating was needed in this country.

Mr. **F. B. Johnson** remarked that it was impossible to feel warm in rooms which had cold walls, and the aim ought to be basic central heating with "topping-up" by other means. And in regard to central heating, what was a coke boiler? It was a solid fuel appliance which would operate perfectly well on anthracite and other natural smokeless fuels; and he would add that these natural fuels were most effective in the coke grate. He would also draw attention to their applicability to closed stoves, which could operate at an efficiency of from 60 to 75%.

Mr. **E. E. Calvert** (Gas Light and Coke Company) suggested that more attention should be paid to the layout of hot-water pipes in a house and to their proper lagging, and that more hot-water radiators might well be employed in conjunction with the coke boiler. In general the producers of coke must pay more attention to the production of a better fuel.

Mr. **E. O. Rose** (Tottenham and District Gas Company) said that England's climate was one which demanded great flexibility of heating arrangements for houses, that the future would witness a greater demand for intermittent heating, and that home-occupiers in the future would not for the most part be prepared to pay for central heating when in fact they might occupy their homes for only a few hours during the day.

Mr. **R. W. Griffin** thought that the open grate burning bituminous coal was doomed on grounds of fuel conservation.

Mr. **C. A. Carlow** remarked that the purpose of the mining industry was to serve the public; its job was to satisfy public demand. Why should the public be denied the open fire? If the public demanded smokeless fuel the mining industry would be prepared to supply the demand. But we did not want regimentation.

The **Chairman** (Mr. F. M. Birks, Gas Light and Coke Company) observed that the problem of coping with peak loads had been dismissed by many people all too lightly, and there was a good deal of talk about "topping-up." There was a wide difference between base load and peak load, and the problem was one demanding careful thought.

Dr. **Foxwell,** replying to the discussion, said that in regard to storage to cope with winter demands, coke, a smokeless fuel, could be stored in the same manner as coal could be stored. And he would remind them that 85% of the people of the country had incomes of under £5 a week, and that they simply had not the money to spend on central heating by underfeed stokers. He visualized the coal industry as working less as individual units and more on a regional plan. In regard to the average price of coal, house coal might fall, but slack coal might rise, in value, and adjustment between washed, low-ash coal and intermediate quality coals could best be made by carbonization at the pithead in many cases. He was interested in the comments on the need for intermittent heating in this country—heating which favoured and justified the use of the gas fire, and he thought the tendency towards intermittent heat requirements was likely to increase. As to regimentation, well, no one wanted regimentation, yet it might be the best thing that could happen to the individual and the community if regimentation was practised in regard to smoke abatement and people were not allowed to burn raw coal.

Manchester Juniors

A Meeting of the Manchester and District Junior Gas Association was held on Nov. 7, when Mr. C. P. Jenkyns gave a lecture on Steam Raising and Boiler Equipment.

The lecturer dealt with the subject in an exhaustive manner, showing how the steam requirements of a works should be calculated, and explained by means of lantern-slides the various types of boilers, with their respective advantages and disadvantages. He also emphasized the necessity for making regular tests of boiler efficiencies, and plotting a graph of the results obtained.

A vote of thanks to the lecturer was proposed by Mr. F. Cartledge (Oldham) and seconded by Mr. E. B. Fields (Blackburn).

Hotwire Vacuum Switches

We have received from Sunvic Controls, Ltd., Stanhope House, Kean Street, London, W.C. 2, an advance copy of their new publication on the industrial and laboratory applications of their Hotwire Vacuum Switches. The system, which is in use in the research departments of many gas undertakings, is suitable for the automatic control of many processes, whether involving temperature control or not, and is of special interest for laboratory work on gas problems.

FUEL TARGET*

By E. S. STREDWICK, South Metropolitan Gas Company

IT has been stated that the "Fuel Target" is a source of bewilderment to many people. It looks too much like algebra. Some simple presentation of the case for economy should, if possible, be devised. Experience on the district has confirmed this opinion, which applies especially to the prepayment type of consumers who normally assess their gas and electricity consumptions by the amount of money placed in the meters each week. As far as domestic consumers are concerned, to keep within the target allowance will entail some inconvenience for many families and possibly hardship for others.

Let us examine the fuel target (the figures quoted relate to the South of England) to see if it does cause hardship or really only inconvenience. Isolated cases may arise, but provision has been made whereby the local fuel overseer has power to grant additional fuel units where real hardship is proved. Hardship in my opinion will arise for one person in one room, and the personal allowance should at least be increased to the allowance for two persons for cooking purposes, the minimum requirements being approximately the same for one as for two persons.

In the annex to the Government paper "Coal," dated June 3, 1942, Clause 16 reads: "If any householder satisfies the local fuel overseer that his previous consumption was not unduly high, it will not be cut by more than 33⅓%." This, I believe, has since been raised to 40%.

Your Fuel Target is, subject to these reservations, therefore, your "Fuel Limit," the assessment being based upon the number of rooms plus a personal allowance, all expressed in fuel units. It is calculated that one Fuel Unit of any fuel detailed below is comparable to the others for domestic uses, such as cooking, water heating, and room heating. The equivalent of 1 Fuel Unit in Coal, Coke, Gas, Electricity or Paraffin is: Coal, ½ cwt., or 56 lb.; coke, ½ cwt., or 56 lb.; Gas, 500 cu.ft. (gas of 500 B.Th.U. C.V. throughout the Paper)—2½ therms; electricity, 50 Board of Trade units; paraffin, 1 gallon.

Taking first the personal allowance, Table I shows us how many fuel units are allowed for various numbers of persons and their equivalents in therms of gas or units of electricity.

TABLE I.—PERSONAL ALLOWANCE.

Number of persons.	Additional fuel units.	Equivalent. Therms.	Board of Trade Units.
1	15	37.5	750
(Rising by 15 F.U. for each person.)			
2	30	75.0	1,500
7	105	262.5	5,250

The personal fuel allowance is sufficient to cover a reasonable allowance for cooking and some allowance for water heating. The water-heating allowance is by no means generous and would perhaps better be termed austere. We know from experience that if you use electricity for cooking you will consume about one Board of Trade unit per person per day; if gas is used for cooking about $\frac{1}{20}$ therm would be required per person per day, and the following calculation demonstrates that whichever medium you use, the requirement is equal to 7.3 Fuel Units in the year. This is equal to half the personal allowance, and we have the remainder available for heating water.

Electricity for cooking.	Gas for cooking.
1 Board of Trade Unit per person per day.	10 cu.ft. or $\frac{1}{20}$ therm per person per day.
× 365 days.	× 365 days.
$= \frac{365}{50}$ B.o.T. Units.	$= \frac{1 \times 365}{20} = \frac{18.25}{2.5}$ therms.
= 7.3 Fuel Units.	= 7.3 Fuel Units.

Water Heating by Electricity or Gas

This is sufficient to allow for 28 gallons of water per person per week throughout 52 weeks per annum with a temperature rise equal to 70°F. This allows one bath per week of 12–14 gallons, the remainder being available for domestic uses.

It will be seen that provision is made for one hot bath per week, say of 18 gallons capacity—*i.e.*, 14 gallons at 120°F. mixed with 4 gallons of cold water at 50–52°F—an additional bath only being possible by reducing the quantity of hot water per bath.

Where families comprise 4–5 persons, the personal allowance allocated to cooking is reasonably sufficient. As regards the hot water service, it would appear from the per capita annual consumptions, especially with the prepayment type, that this service is largely supplied *via* public baths and solid fuel. If both these services were provided in full by gas, the Target "Personal Allowance" would represent a considerable increase in our domestic gas sales. Where gas is used to provide both the cooking and water-heating services, in order to keep within the personal allowance the mean weekly gas consumption should not exceed 144 cu.ft. or 0.7 therm, costing at 6d. per therm 12d. per person per week. The fixed, "Room Basis" allowance has to provide for room heating, lighting, ironing, and wireless.

Lighting.—Assessed at the equivalent of 100 watts in use for 1,500 hours per annum = 150 Board of Trade Units.

Ironing and Wireless.—Assessed at the equivalent of 50 watts in use for 1,000 hours per annum = 50 Board of Trade Units.

Lighting, ironing, and wireless, therefore, account for 4 Fuel Units.

The balance of the room basis allowance is allocated to room heating. Table II gives these Fuel Units and their equivalent in cubic feet, therms, and Board of Trade Units.

TABLE II.

Number of rooms.	Fuel units available for room heating.	Coal or coke, cwt.	Gas, 1,000 cu.ft.	Gas, therms.	Equivalent to—Electricity, Bd of Trade units.	Paraffin, gallons.
1	46	23	23	115	2,300	46
2	56	28	28	140	2,800	56
3	66	33	33	165	3,300	66
4	76	38	38	190	3,800	76
5	86	43	43	215	4,300	86
6	96	48	48	240	4,800	96
7	106	53	53	265	5,300	06

It might prove an advantage if a pamphlet was issued to prepayment consumers showing the limitation of the "Personal Allowance" expressed in pence per person per week.

The "Room Basis" allowance might follow, showing the number of fuel units available and their equivalent expressed in cwt. of solid fuel.

The suggested wording and layout could be as the accompanying specimen:

SPECIMEN PAMPHLET "A."

YOUR FUEL TARGET. PERSONAL ALLOWANCE SECTION.

Number of fuel units per person per annum.	Equivalent in gas. Cubic feet.	Therms.
15	7,500	37.5

Where gas is used exclusively for cooking and water heating, the amount of money to be placed in the meter should not exceed 12d* per week, *per person*.

If your household comprises:

2 persons the amount should not exceed . . 2s. per week
3 " " " " " " . . 3s. "
and so on.

ROOM BASIS SECTION

After allowing for 200 Board of Trade Units or the equivalent of 4 Fuel Units for electric lighting and wireless, the balance of this section is available for room heating. Select from the table below the number of rooms corresponding to your premises, and note the number of the Fuel Units and their respective equivalent in hundredweights of coal or coke, or in therms of gas.

Number of rooms.	Number of fuel units.	Equivalent in—Coal or coke per annum.	Gas (therms) per annum.
1	46 per annum	23 cwt.	115
2	56 " "	28 "	140
3	66 " "	33 "	165
4	76 " "	38 "	190
5	86 " "	43 "	215
6	96 " "	48 "	240
7 or more	106 " "	53 "	265

Where electric fires are used it is a simple calculation to convert cwt. to electricity (B.o.T. units). For example, the Table shows that a 4-roomed dwelling is entitled to 38 cwt. The electrical equivalent is 38 cwt. × 100 B.o.T. units per cwt. = 3,800 B.o.T. units.

What significant features arise from this examination? We have seen that the Personal Allowance, which barely covers our individual needs for cooking and water heating, would, if provided by gas, represent a considerable increase in our domestic sales. Yet, before the war, competition for these loads was so intense that a position was being reached which made them an unprofitable proposition to either undertaking. For the sake of those who survive this conflict, can we anticipate that they will find upon return that the good relations now existing between the gas and electricity undertakings during the war are to be continued in post-war years, and that as a result of this, competition will be replaced by co-operation?

From a fuel economy point of view, the target figures reveal that:

	Fuel units*
1 ton of coal used as coal is equal to	40
1 " " treated in a gas-works yields, in addition to tar, 75 therms of gas . . . . 30 fuel units and 10 cwt of coke . . 20 " "	50

* This price to be adjusted according to the price per therm.

* From a Paper to the London and Southern District Junior Gas Association, Nov. 20.

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MADE IN SIZES FROM
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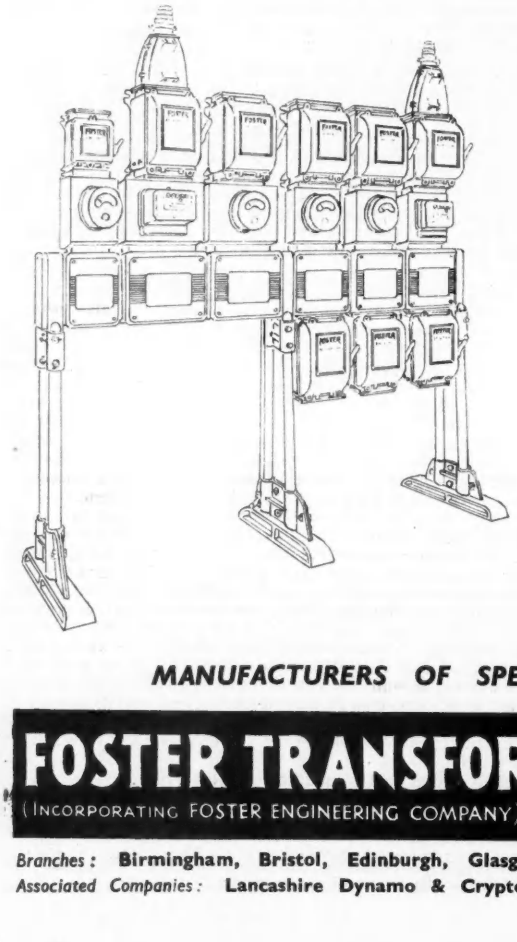
Designed for H.R.C. fuses and tor use under the most exacting working conditions. Complete fuse isolation when the switch is "off"—weather-proof and fume-resisting.



Unit constructed switchboards specially designed for the Gas Industry.

Many are already in service with important undertakings.

MANUFACTURERS OF SPECIAL ELECTRICAL GEAR SINCE 1903

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The use of gas and coke for the provision of a heating service makes so large a contribution to fuel conservation that a great extension of the Gas Industry is essential. From the national point of view, replacement of raw coal in the home by gas and coke would be a valuable advantage. The only question is whether this service can be given at the price the consumer can afford.

The price of household coal to-day is approximately 3s. 4d. per cwt.; the comparable price of gas, therefore, is 8d. per therm. Table II shows the magnitude of the domestic room-heating load, untouched as yet by the Gas Industry.

From the consumer's point of view, the coal fire has such an inherent attraction, irrespective of the work involved, that gas fires must not only be made attractive in appearance and efficient in use, but the commodity rate for gas must be little if any above solid fuel costs. Even if these facilities are made available it will not be an easy task to persuade the average householder to change from solid fuel to gas for room heating.

Still using the Target figures, let us look at the room-heating load. This allows for 182 days per annum as representing the period for room heating; the room basis allowance (Table II) is further analyzed to show the gas rate per hour available.

TABLE III.—Room Heating.

Number of rooms.	Number of fuel units per annum.	Coal in lb. per day	Coal lb. per hour, 10 hours per day.	Cu.ft. per day.	Gas rate per hour, 8 hours per day.
1	46=23 cwt.	14	1.4	126	16 cu.ft.
2	56=28 „	17	1.7	154	20 „
and so on—					
7	106=53 „	33	3.3	291	36 „

Note.—Coal assessed at 10 hours as compared with 8 hours for gas fires—this adjustment to allow for greater flexibility and convenience in turning on and off as required. It will be seen that with this hourly gas rate, the heat input into the rooms varies between 32,000 and 72,000 B.Th.U. per day when allowing for an overall efficiency of 50%.

(*To be concluded*)

INDUSTRIAL GAS ECONOMY*

By EDMUND BATES, Manchester Gas Department

(*Concluded from p. 199*)

One of the furnaces was reported to be working very well on one side and badly on the other. It was found that an explosion door at the base of the regenerator (on the bad side) was, though apparently shut, passing a large volume of air which should, of course, have been passing through the hot chequer work and mixing with the gas to burn in the furnace. The door joint was sealed with fireclay and the furnace then worked perfectly on both sides. A regular inspection is now made once a week, any faulty joints being made good.

Water also gave trouble by seeping into the furnace pit, thereby finding its way into the regenerators, evaporating, and absorbing heat from the furnace chamber. As a number of furnaces were affected over the site, a well was sunk and a pump now keeps the water at a safe level. Since this was done the affected furnaces have attained higher temperatures with a lower fuel consumption.

Billet reheating furnaces of this type work at a temperature of approximately 1350°C., so it can be realized that without insulation an excessive heat loss would occur through the walls and arches. Too much insulation, however, will cause the inner course of refractory to melt, so care must be taken in this direction.

Where furnaces are operating in conjunction with drop stamp or steam-hammer plants, a regular inspection of the gas pipe lines should be made in order to ensure that no joints have worked loose due to the heavy vibration.

Furnaces of this type used for annealing, hardening, normalizing, and tempering, and working at a maximum temperature of 900°C., are often fitted with automatic controlling equipment which, besides saving gas, enables correct operating conditions to be maintained.

It is important that all furnaces be lighted up with great care. If a furnace is rushed up to temperature from the "green" state, uneven expansion causes brickwork to crack and joints to open—factors which will continue to affect adversely the gas consumption throughout the whole working life.

Central Heating

A complaint received from a welfare centre regarding excessive consumption of the central-heating apparatus, and its cure, will serve as a typical illustration of how it is possible to save gas in this direction. The heating system comprised a horizontal firetube hot water boiler, which fed pipes and radiators throughout the building on the gravity system. The draught stabilizer in the flue was found to be sluggish in action, due to dirt and rust. This meant that the quantity of air induced into the boiler tubes varied considerably, with consequent inefficiency of operation. By cleaning, oiling, and readjusting the stabilizer against flue gas analyses taken on the gases leaving the boiler, a correct setting was obtained. When the burners were on the pilot setting due to the operation of the thermostat, however, excess air was still drawn in. An automatic gas pressure operated damper fitted in the flue reduced losses in this direction. The pilot light setting was also found to be higher than necessary. This was reduced to a minimum safe limit by adjustment on the relay valve.

Cleaning was not being carried out effectively, so this was taken over by the Gas Department, who have skilled men available, with adequate tools for the job. Four visits per heating season are considered satisfactory for this class of boiler.

Heat was lost due to windows being opened to cool certain rooms. By balancing the hot water circuits and lowering the thermostat setting this was quickly remedied, ventilation still being ample. A number of the rooms led off from a central unheated hall fitted with swing entrance doors. Due to a faulty door closer, one of these doors was constantly open, thus allowing cold air to enter the building. A simple repair rectified this, and heat was saved.

Children were stripped for medical examination in one room and babies were weighed in another. An air temperature of approximately 70°F. is required for comfort under these conditions, and as this meant a large quantity of gas on the boiler, gas fires were installed in these rooms to provide radiant heat as and when required, an air temperature of 60°F. to 65°F. then sufficing. These adjustments and modifications resulted in a saving of approximately 17% on the gas previously used.

Steam Boilers

The cleaning and inspection of steam boilers at least once a month is highly desirable if a high efficiency (approximately 75%) is to be maintained. This service should include cleaning burners, tubes, and all boiler mountings, also checking water gauge, blowing down boiler, inspecting pressurestat, and making sure that feed water supply, injector, hand pump, or automatic feed pump, are in working order and correctly adjusted. The flue should also be checked for pull and, if necessary, any dirt cleaned out. Where boiler flues discharge into vertical brick shafts, a small door fitted a short distance below the point of entry is useful for cleaning purposes.

With Bonecourt type boilers it is important that the spirals in the tubes should be kept at the correct length, as there is a tendency for them to burn away in time. The boiler should be insulated together with all steam pipes, and where practicable the apparatus using the steam should also be covered. A case in point was that of a boiler installed to feed two rubber presses. By boxing in the heads of the presses and filling in with slag wool, insulating all steam pipes, feeding the hot condense back to the boiler, and avoiding any steam leaks, it was eventually found possible to supply a further four presses from the same boiler.

In hard water districts, scale formation should be avoided by suitable treatment of the feed water.

Where pressurestats are employed, it is an advantage to run the boiler at some 10 lb. per sq. in. pressure below that of the safety-valve setting.

As every pound of steam generated at 70 lb. per sq. in. pressure requires approximately 3 cu.ft. of gas, it will be seen there is ample opportunity to save gas on the average steam boiler installation.

Diecasting

A zinc alloy die-casting machine was inspected recently with a view to increasing production. The machine consists essentially of a gas-heated pot from which the metal is pumped into water-cooled dies.

The gas-burner equipment is made up of a well-designed injector, which supplies, through a 2-in. mixture tube, a hollow cast-iron burner head fitted with drilled nipples. As it stood, although the air adjustment on the injector was fully open, the flames were much under-aerated. In most cases the burner port area should, theoretically, equal the area of the mixing tube, but in this case it was found to be well below this criterion. Fifteen additional ¼-in. dia. holes were drilled, therefore, in the burner head to meet this requirement. It was then possible to obtain a fully aerated flame with a gas rate in cu.ft. per hour equal to 100 times the area of the mixing tube in sq. in., which is the theoretical maximum rate for a natural draught burner. Another point in the design of aerated gas burners is that the distance of the first burner port from the injector should be at least six times the diameter of the mixing tube. The latter requirement was well met in this particular case.

On trying out the die-caster after the burner alteration, it was noticed that there was a baffling effect in the combustion chamber due to the lack of flue pull. A baffler had been fitted on the end of the 4-ft. standard length of flue pipe supplied with the machine, so this was removed and fitted at a point some 12 ft. higher up the flue, thus giving a 16-ft. effective primary stack. This cured the baffling of the flame by allowing additional secondary air to enter, and in this way complete combustion resulted. Besides these alterations, the outside of the pot was insulated, incidentally improving conditions for the operator.

In this way the output of the machine was increased from 700 lb. to 1,050 lb. of cast metal per 7½ hour shift, no extra gas being used. This means a constant saving of 33⅓% in fuel alone.

* From a Paper to the North-East Lancashire Discussion Group at Burnley, Oct. 7.

Gas Products Prices

The London Market Nov. 23.

The only item of interest in connexion with the London Coal Tar Products market is that fair quantities of Pitch are being sold on the basis of 45s. per ton naked at Makers' Works. Otherwise no change.

The Provinces Nov. 23.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 10d., pure, 2s. 5d. (controlled by the Control of Toluene No. 2 Order, July 3, 1941, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North, 1s. to 1s. 4d. according to quality. Solvent naphtha, naked, North, 2s. 2d. to 2s. 6d. Heavy naphtha, North, 1s. 10d. to 1s. 11d. Carbolic acid, 60's, controlled by the Coal Tar Acids Prices (Inland) Order, 1942, operative from May 1. Naphthalene, controlled by the Naphthalene prices (Inland) Order, 1942, dated April 15, 1942, and operative from May 1, 1942, £19 to £19 10s.—bags free. Anthracene, controlled by the Anthracene Prices (Inland) Order, 1942, operative from May 1. Filtered heavy oil (min. gr. 1,080), 7¼d. to 8d. Creosote oil has been generally controlled as to direction and price for some time past. Current value—fuel grades 5d. to 5½d; timber preservation and other purposes 4¾d. to 6d. These prices apply as from May 13.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Tar Products in Scotland Nov. 21.

Some products are, if anything, more plentiful. Refined tar controlled. Value is 4½d. per gallon *ex* Works, naked. Creosote oil: Specification oil, 6¾d. to 7d.; low gravity, 7¼d. to 7½d.; neutral oil, 6¾d. to 7d. per gallon; all *ex* Works in bulk. Refined cresylic acid can be secured at 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha: 6½d. to 7d. Solvent naphtha: 90/160 grade, 2s. 5d. to 2s. 6d., and 90/190 Heavy naphtha, 1s. 11d. to 2s. per gallon. Pyridine: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

Gas Stocks and Shares

The turnover in most sections of the Stock Exchange was on a reduced scale last week, and with some profit-taking in evidence a number of prices turned reactionary. The Gas Market, however, was a notable exception and securities in this section were in good demand. The effect of this can be seen in the list below giving the rises in prices on the week. Gas Light units again attracted a large number of investors and closed 9d. higher. Strong features were the sharp gains made by Croydon and Wandsworth 5% debenture stock, both of which showed gains of 11 points to 122½ or 20 points higher than on the 1st January last. Alliance and Dublin ordinary also made a spectacular rise, and with parcels of stock changing hands at 50 Commercial again hardened and eventually closed 5 points higher.

The following quotations were altered during the week:

OFFICIAL LIST

Alliance & Dublin Ord.	108—113	+13
British Ord.	76—81	+1
Colombo 7 p.c. Pref.	20/—22/-	+1/-
Commercial Ord.	50—55	+5
Croydon max. Div.	86—91	+1
Ditto 5 p.c. Deb.	120—125	+11
Gas Light Units	17/3—18/3	+-/9d.

OFFICIAL LIST—*continued.*

Gas Light 3¾ p.c. Red. Pref.	78—83	+1
Mid-Southern "C"	77—82	+2
Montevideo Ord. (*x.d.*)	87—92	Nov. 16
Oriental	86—91	+1
South Metropolitan Ord.	72—77	+2
Ditto 6 p.c. Pref.	88—93	+1
South Suburban 4 p.c. Pref.	80—85	+2
United Kingdom Gas Corporation 4½ p.c. 1st Cum. Pref. (*x.d.*)	18/—20/-	Nov. 16
Ditto 4 p.c. 1st Red. Cum. Pref. (*x.d.*)	16/—18/-	"
Wandsworth Cons.	84—89	+2
Ditto 4 p.c. Pref.	80—85	+1
Ditto 5 p.c. Deb.	120—125	+11

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Newcastle 3½ p.c. Deb.	92—93	+2½

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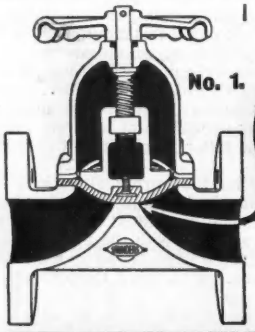

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CONTENTS

EDITORIAL NOTES

Opinion 279
Coal Output and Fuel Target . . 279
Appliance Research 280
Midland Section, Institute of Fuel . 280

1942 "JOURNAL" Directory . . 280
Personal 280
Letters to the Editor 280

Manchester District Association . . 281
Harrogate "Battle for Fuel" . . 281
Building and Civil Engineering (Restriction on Transfer) Order, 1941 . 281
"Utility" Gas Lighters 281
Appliance Research 281
Midland Section of Institute of Fuel . 282
Fuel Economy 282
New Londex Process Timer . . 282

Justification for Development. By E. V. Evans, O.B.E. 285
Thought Trend in the Gas Industry. By G. L. Braidwood 286
Fuel Target. By E. S. Stredwick (*concluded*) 293

Gas Products Prices 294
Gas Stocks and Shares 294

THIS WEEK'S ADVERTISERS

	PAGE
Abbott, Birks & Co., Ltd.	267
Alder & Mackay, Ltd.	292
Ashworth & Parker, Ltd.	272
Bale & Church, Ltd.	S3
Beattie, S. N., & Co., Ltd.	S3
Birmingham Electric Furnaces, Ltd.	277
Blakeley, Firth, Sons & Co., Ltd	S3
Bratt, Colbran, Ltd.	265
British Gas Purifying Materials Co., Ltd.	S3
Carter, G. M. (Erectors), Ltd.	275
Chaseside Engineering Co., Ltd.	269
Clapham Bros., Ltd.	271
Cort, Robt., & Sons, Ltd.	Cover I
Cowan, W. & B.	Cover III
Crone & Taylor, Ltd.	Cover II
Cutler, Samuel & Sons, Ltd.	287
Curtis, A. L.	S2
Dempster, Robert, & Sons, Ltd.	S3
Diaphragm & General Leather Co., Ltd.	264
Donkin Co., Ltd. (The Bryan)	Cover II
Ellison Insulations, Ltd.	S3
Evans, Joseph & Sons (Wolverhampton), Ltd.	264
Flavels of Leamington	S2
Fluxite, Ltd.	S4
"Four Oaks" Spraying Machine Co.	268
Frost, A. E.	S3
Gas Purification and Chemical Co., Ltd.	S3
Gas Meter Co., Ltd.	266
Gerber Power Units	S4
Gibbons (Dudley), Ltd.	262
Glover, George, & Co., Ltd.	261
Glover, Thos., & Co., Ltd.	278
Goodall, Clayton & Co., Ltd.	Cover IV
Grant, David, & Co.	268
Green & Boulding, Ltd.	S4
Harrisons (London), Ltd.	S3
Holmes, W. C., & Co., Ltd.	S3
Humphreys & Glasgow, Ltd.	276
Hyde, Silas, Ltd.	270
Jobling, James A., & Co., Ltd.	270
Keith Blackman, Ltd.	S6
King's Patent Agency, Ltd.	S4
Laidlaw, R., & Co. (Edin.), Ltd.	272
Londex, Ltd.	S3
London Electric Firm, The	S2
Macpherson, Donald, & Co., Ltd.	275
Main, R. & A., Ltd.	290
Manchester Oxide Co., Ltd.	273
Mavitta Drafting Machines, Ltd.	S2
Mewburn, Ellis & Co.	S4
Milne's Meters, Ltd.	274
Ministry of War Transport	263
Mitchell, H., & Co.	S3
Newton Chambers & Co., Ltd.	284
Parkinson, W., & Co.	278
Pulsometer Engineering Co., Ltd.	Cover IV
Radiation, Ltd.	288, 289
Reavell & Co., Ltd.	274
Sawer & Purves, Ltd.	292
Siebe, Gorman & Co., Ltd.	S2
Slingsby, Walter, & Co., Ltd.	S3
Stanton Ironworks, Ltd.	S4
Strachan & Henshaw, Ltd.	261
Sutcliffe, Speakman & Co., Ltd.	267
Thomas & Bishop, Ltd.	294
Trotter, Haines & Corbett, Ltd.	S4
Tully, Sons & Co., Ltd.	274
Turbine Furnace Co., Ltd.	S2
Walker, C. & W., Ltd.	287
West's Gas Improvement Co., Ltd.	S1
Woodall-Duckham Co., Ltd.	283
Underpressure Engineering Co., Ltd.	Cover IV
Trade Cards	294
Appointments Vacant	S4
Consultant-Designers	S4
Gas-Works Wanted	S4
Patents	S4
Plant, &c.	S3
Plant, &c., for Sale and Wanted	S4

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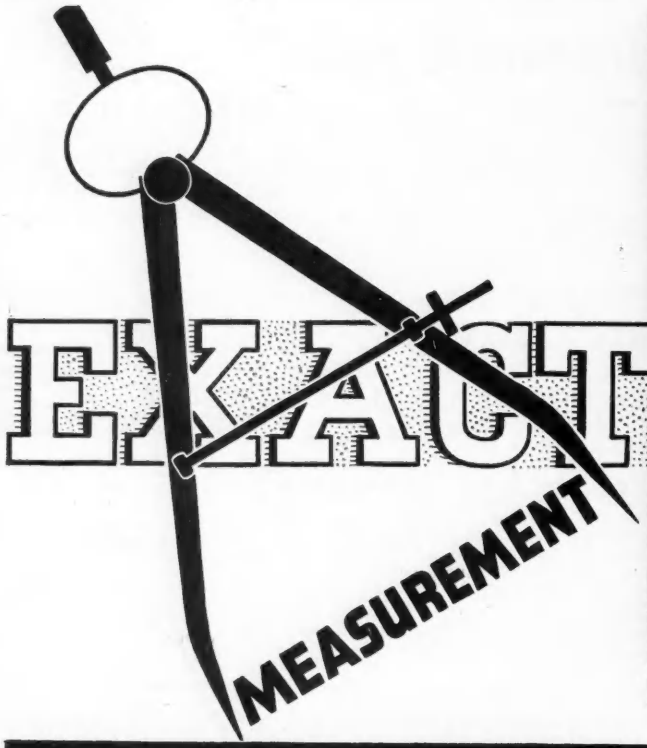

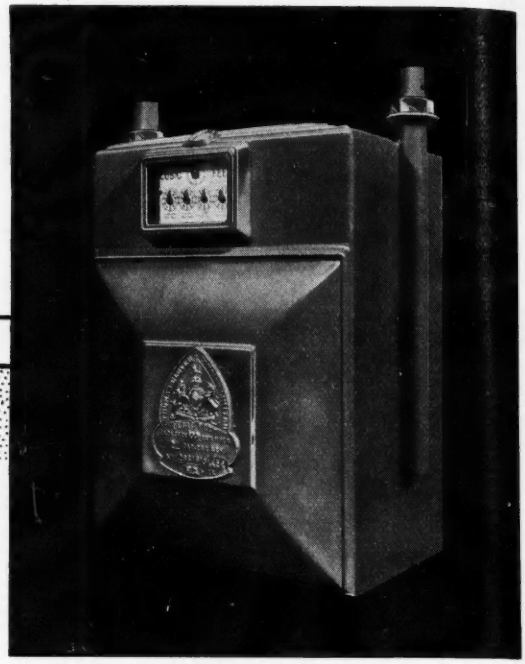

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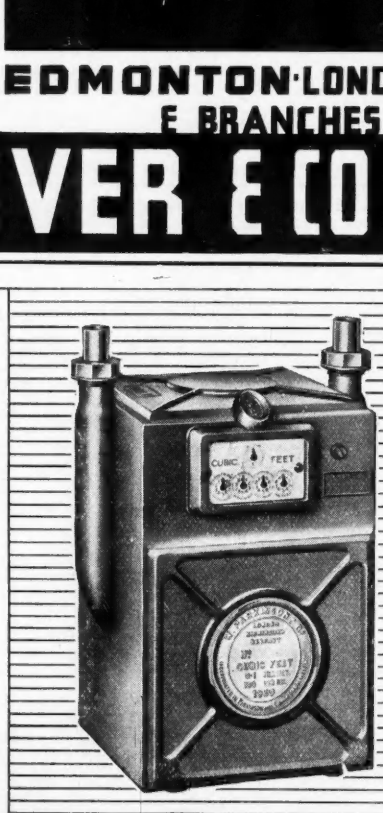

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